



Seema's  
**KUNAL ACADEMY**  
 an educational hub

Geeta

V - VIII | IX - X ( COMBO ) | XI XII SCIENCE ( MHT-CET | JEE | NEET ) | XI - XII COMMERCE

Std: Science (12th)

Subject: Physics

Time: 2Hrs

Date : 07/Jan/2023

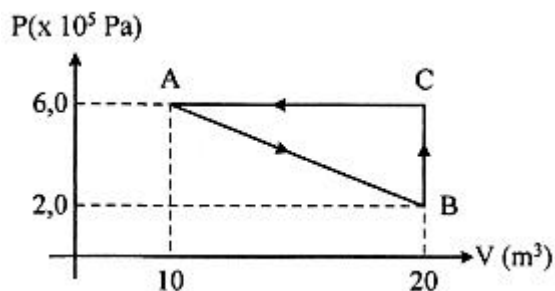
ANS IN ONE SENTENCE

Max Marks: 251

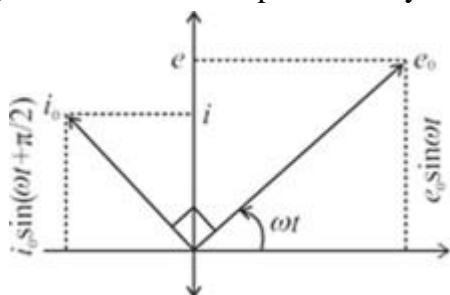
**Q.1 Answer the following very short questions:**

251

- 1) What does the Zeroth law of thermodynamic state?
- 2) How is resolving power of an optical instrument related to limit resolution?
- 3) What should be retentivity and coercivity of permanent magnet?
- 4) The maximum acceleration of a particle performing linear S.H.M is  $0.64 \text{ m/s}^2$ . If its maximum speed is  $0.16 \text{ m/s}$ , calculate the period of oscillation.
- 5) Name the two factors on which the self inductance of an air core coil depends.
- 6) What is the work done in process A-B-C-A?



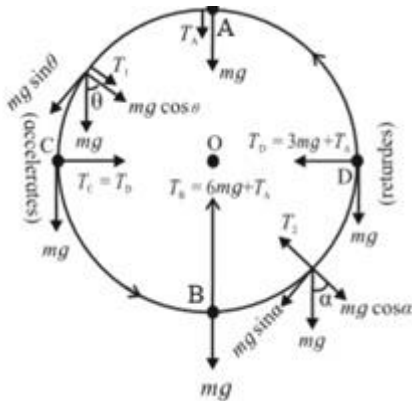
- 7) A small stone of negligible mass is tied to an inextensible string and rotated in a circle of radius  $2 \text{ m}$  in a vertical plane. Find the speed at a horizontal point on the circle.
- 8) What is the use of a Moving coil galvanometer?
- 9) When is the condition when electrostatic potential energy is zero?
- 10) Which circuit is represented by the given phaser diagram?



- 11) What happens during regulation action of a Zener diode?
- 12) What is the angle between Plane of polarisation and plane of vibration?
- 13) What happens to the width of depletion layer of a p-n junction when it is
  - (i) forward biased,
  - (ii) reverse biased?
- 14) Define ionization energy.
- 15) What type of electric current flows in a closed coil due t change in magnetic flux. What type of electric current flows in a closed coil due t change in magnetic flux.
- 16) A vertical offshore structure can take a maximum stress of  $10^{10} \text{ Pa}$ . Can this structure survive on top

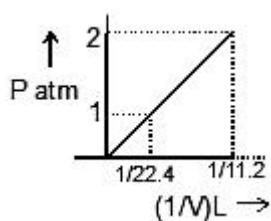
of an oil rig in a sea of depth 5 km?

- 17) What happens when a transverse wave reflects from a denser medium?
- 18) What are degrees of freedom?
- 19) A parallel plate capacitor has an area of  $3 \text{ cm}^2$  and a plate separation of 4 mm. Find the capacitance of the capacitor.
- 20) A cylindrical glass tube is 34 cm long. If both ends of the tube are open. What is fundamental frequency of vibration of air column? Neglect end correction. (Velocity of sound in air is 340 m/s)
- 21) On which variable does the ferromagnetism depends on?
- 22) What is resultant centripetal force at point B?

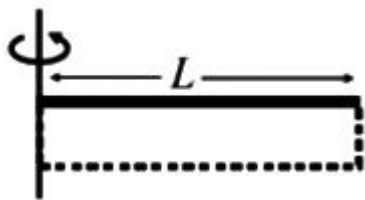


- 23) What is quantity analogous to linear momentum in rotational dynamics?
- 24) What are Boolean expressions?
- 25) Explain why in photoelectric effect, the photoelectric current should increase as the intensity of monochromatic radiation incident on a photosensitive surface is increased.
- 26) Why no positively charged particles are emitted by the atoms?
- 27) What are non-harmonic oscillations?
- 28) State the Pascal's law.
- 29) The optical path difference between two identical waves arriving at a point is  $37 \lambda$ . Is the Point dark?
- 30) What is the value of electric current flowing through the auxiliary cell and the other cell in the balanced condition of the potentiometer?
- 31) What is the maximum value of the adiabatic ratio?
- 32) What is the net dipole moment of bulk materials?
- 33) What is a thermodynamic process?
- 34) In Davisson – Germer experiment, what is the glancing angle if the angle of diffraction is  $52^\circ$ ?
- 35) What is a photo cell?
- 36) What are dielectrics?
- 37) Calculate the work done in bringing a charge of  $5 \mu\text{C}$  to a point where the potential is 5 V.
- 38) Define oscillatory motion.
- 39) State the necessary condition such that a motor cyclists driving in a vertical circle inside a well of death may not fall down?
- 40) Can a charged particle move in a magnetic field, without experiencing any force?
- 41) Define Potential Gradient.
- 42) What is wattles current?
- 43) What do you mean by shunt?
- 44) What is the effect on the interference fringes in a Young's double slit experiment, if the width of the source slit is increased?

- 45) The combined resistance of a galvanometer of resistance  $500\Omega$  and its shunt is  $21\Omega$ . Calculate the value of shunt.
- 46) What are stable orbits?
- 47) Define coefficient of self induction.
- 48) A body of mass  $0.8\text{ kg}$  is performing linear S.H.M. A restoring force of  $0.2\text{ N}$  acts when the displacement from the mean position is  $4\text{ cm}$ . Determine the period of S.H.M.
- 49) State two applications of beats.
- 50) What is the magnetic force per unit length of a wire carrying a current of  $8\text{ A}$  and making an angle of  $30^\circ$  with the direction of a uniform magnetic field of  $0.15\text{ T}$ ?
- 51) What is the equipotential surface of a single point charge and a line charge?
- 52) What is atomic mass unit?
- 53) Name at least one application of electromagnets.
- 54) Calculate the work done for an ideal gas ( $\ln 2 = 0.7$ )



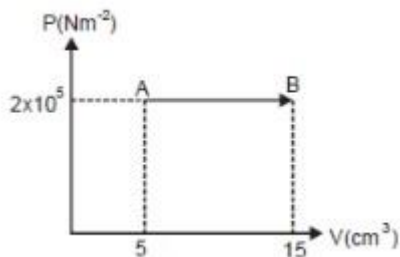
- 55) Give a few examples of intensive variables.
- 56) Why is the I-V characteristics of a typical solar cell drawn in fourth quadrant?
- 57) Can microwaves be used in the experiment on photoelectric effect?
- 58) Why is use of mercury not advised in laboratory?
- 59) Define linear S.H.M.
- 60) What is viscosity?
- 61) What is an ideal gas?
- 62) What is the length of the wire used in Meter Bridge?
- 63) What can be said about the intermolecular interaction in ideal gas?
- 64) What is a post office box?
- 65) Which law of thermodynamics give the mathematical relation between the heat and work?
- 66) Can an inductor reduce DC voltages?
- 67) What is a phase difference between two points on the same wave front?
- 68) For a given conical pendulum, what is the factor affecting the time period and the frequency?
- 69) Write the expression of banking angle while designing a road.
- 70) Name that quantity in electrical circuits which play the same role as inertia in mechanics.
- 71) What is the moment of inertia of the uniform rod about an axis shown in the diagram?



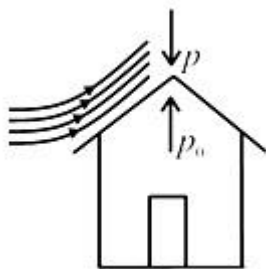
- 72) A circular coil of wire consisting of  $100$  turns, each of radius  $8.0\text{ cm}$  carries a current of  $0.40\text{ A}$ . What is the magnitude of magnetic field at the centre of the coil?
- 73) The magnetic flux linked with a coil changes to  $12\text{ wb}$  to  $10\text{ wb}$  in  $0.02\text{ sec}$ . calculate the emf induced.

- 74) An ideal inductor is in turn put across 220 V, 50 Hz and 220 V, 100 Hz supplies. Will the current flowing through the inductor in the two cases be same?
- 75) Which orbit of an atom do not contribute to the total magnetic moment?
- 76) What is the phase difference between the interfering waves for destructive interference?
- 77) What will happen to the mean square speed of the molecules of a gas if the temperature of the gas increases?
- 78) What is Plum-pudding model?
- 79) What is electromagnetic induction?
- 80) Why do humans get electric shocks?
- 81) What happens when a longitudinal wave reflects from a denser medium?
- 82) Starting with the general expression of displacement of a particle executing S.H.M, what is the expression of velocity of a particle executing S.H.M?
- 83) What is an equipotential surface?
- 84) Energy of all molecules of a monatomic gas having a volume V and pressure p is  $\frac{3}{2}PV$ . What is the total translational kinetic energy of all molecules of a diatomic gas at the same volume and pressure?
- 85) Why does magnet becomes stationary after rotating for a while?
- 86) How is an ammeter connected in a circuit?
- 87) What is thermal equilibrium?
- 88) The reverse current in a photodiode depends on which factor? Assume that the diode is illuminated.
- 89) What is photoelectric effect?
- 90) A vehicle driving at 15 m/s can safely negotiate a curved road of 50 m radius. If the road is unbanked, find the co-efficient of friction between the road surface and the tyres.
- 91) What is harmonic motion?
- 92) To form a soap film between the wires, a U bent wire is dipped in a soap solution and removed. This film and a light slider can support a weight up to  $2.5 \times 10^{-2}$  N (including the slider's weight). If the slider is 30 cm long, find the surface tension of the film.
- 93) What are isotopes?
- 94) How is a voltmeter connected in a circuit?
- 95) Under what condition can a real gas be considered as an ideal gas?
- 96) What is 'diffraction of light'?
- 97) Define the thermometer.
- 98) Why are molecular forces known as short range forces?
- 99) What is gauge pressure?
- 100) What is macroscopic description of a gas?
- 101) Define equation of state?
- 102) Define the peak value of an alternating current?
- 103) A fly wheel gains a speed of 240 rpm in 3 s. What is the change in its angular speed in three seconds?
- 104) Why is it necessary to introduce a cylindrical soft iron core inside the coil of a galvanometer?
- 105) The capacity of a parallel plate condenser is 7  $\mu$ F. When a glass plate is placed between the plates of the conductor, its potential becomes 1/8th of the original value. Find the value of dielectric constant?
- 106) Why we cannot use moving coil instruments to measure alternating current and voltages?
- 107) State the principle of superposition of waves.
- 108) What is constructive interference?
- 109) What is the distance between a node and an adjacent antinode?

- 110) Define isotones.
- 111) State Lenz's law.
- 112) State the principles of the electric generator.
- 113) Why is a stationary wave so named?
- 114) Define a wave front.
- 115) What is electrostatic potential energy?
- 116) Two straight wires A and B of lengths 10 m and 16 m and carrying currents 4.0 and 5.0 A respectively in opposite directions, lie parallel to each other 4.0 cm apart. Compute the force per unit length on each wire.
- 117) What is the ratio of magnetic moment to the volume of the material?
- 118) Define mutual inductance.
- 119) What is the work done by helium gas in the process AB as shown in the graph?

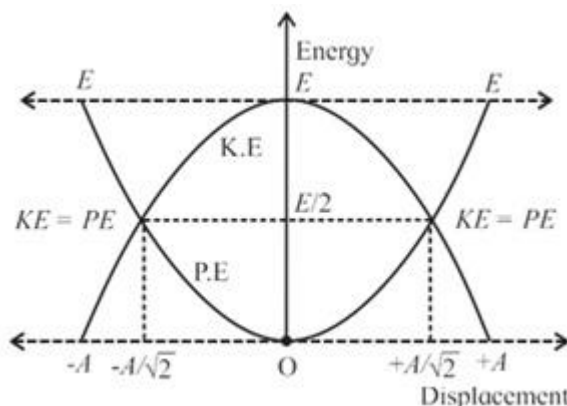


- 120) Out of the two types of transistors available which one is more useful and why?
- 121) What is saturation current?
- 122) Explain the mechanism shown in the image.



- 123) What is indicated when the phase angle is  $90^\circ$ ?
- 124) What is plasma?
- 125) Mention the conditions under which a real gas obeys ideal gas equation.
- 126) In a Wheatstone's meter-bridge experiment, the null point is obtained in middle one third portion of wire. Why is it recommended?
- 127) What happens when a gas molecule in Brownian motion approaches another gas molecule?
- 128) Where should the null point is ideally found?
- 129) What is a surrounding in thermodynamic process?
- 130) Can we interchange the resistance box and the unknown resistance in case of a meter bridge?
- 131) Two tuning forks of frequencies 250Hz and 255Hz are sounded together. Find the time period of the beat produced.
- 132) What happen to the frequency of tuning fork, when its prongs are loaded with wax and on filling its prongs?
- 133) The velocities of the molecules are  $v$ ,  $2v$ ,  $3v$ ,  $4v$  &  $5v$ . What is the rms speed?
- 134) What is the ratio of average kinetic energy per molecule of hydrogen and chlorine?
- 135) What is the law of conservation of angular momentum?
- 136) Find the magnetic moment of a coil of area  $10\text{sq cm}$  having a current of 2amp.

- 137) Out of AC and DC, which is passed easily through an inductor and which is blocked by an inductor?
- 138) How does electric resonance take place?
- 139) A flexible wire 80cm has a mass 0.4 gm. It is stretched by a force of 500N. Find the velocity of the transverse wave in the string.
- 140) What is the path difference between the interfering waves for constructive interference?
- 141) The fundamental frequency of vibration of a stretched string is 200Hz. find the frequency of the first overtone if the tension increases four times.
- 142) What is mass number?
- 143) Write a relation between Henry and Weber.
- 144) How can one determine the direction of angular velocity in case of circular motion?
- 145) Write the wave equation traveling in the negative x direction.
- 146) How does the self inductance of a coil depend on the number of turns of the coil?
- 147) Define 1 Joule in terms of electrostatic potential energy.
- 148) What is meant by interference of light?
- 149) What kind of energy takes place when the electric dipole is kept in the electric field?
- 150) State the reason, why two independent sources of light cannot be considered as coherent sources.
- 151) What is a toroid?
- 152) How can one increase the sensitivity of a photodiode?
- 153) A particle is dropped from a height H. What is the variation of de Broglie wavelength of the particle with height?
- 154) What sets the limits on efficiency of a heat engine?
- 155) Define frequency of S.H.M.
- 156) Why is the surface tension of paints and lubricating oils kept low?
- 157) Two parallel plate capacitors A and B have the same area of plates and the same separations between them. A has air between the plates while B contains a dielectric medium of  $K = 4$ . Calculate capacitance of each capacitor if equivalent capacitance of the combination is  $4 \mu\text{F}$ ?
- 158) If we interchange the positions of galvanometer and cell in whetstone's bridge will there be any change in the null point?
- 159) What is mean free path?
- 160) Observe the graph carefully and answer.

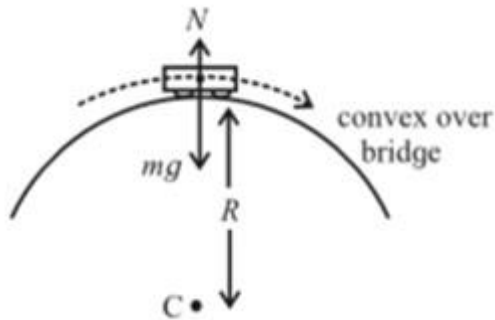


At what point is the energy 25% potential and 75% kinetic?

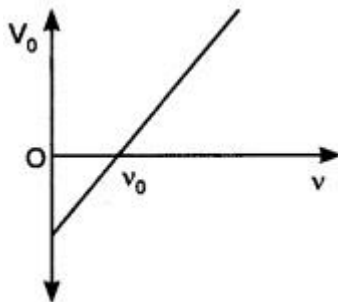
- 161) What are the types of thermodynamic systems?
- 162) Which property of soft iron makes it useful for preparing electromagnet?
- 163) Is it always possible to see photoelectric effect with red light?
- 164) What is the nature of the force between two parallel currents?



- 165) Is the density of a nucleus different for different nuclei?
- 166) Express the masses of the subatomic particles in  $eV/c^2$ .
- 167) The figure given below, shows the forces acting on a vehicle on a convex over – bridge. What is the upper limit of the speed of the vehicle in such a case?

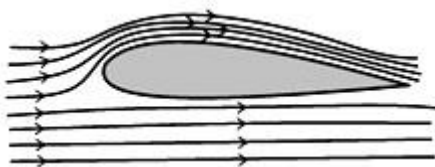


- 168) Can a magnetic field change the velocity of a charged particle?
- 169) Does the value of polarising angle depend on the colour of light?
- 170) Define a phasor.
- 171) A 40 kg lady balances on her right stiletto heel. Calculate the pressure on the floor due to the heel if the diameter of the circular heel is 0.8 cm?
- 172) When monochromatic light travels from one medium which quantity remains the same?
- 173) What is the rest mass of a photon of wavelength  $\lambda$ ?
- 174) The stopping potential  $V_0$  for photoelectric emission from a metal surface is plotted along y-axis and frequency  $\nu$  of incident light along x-axis. A straight line is obtained as shown.

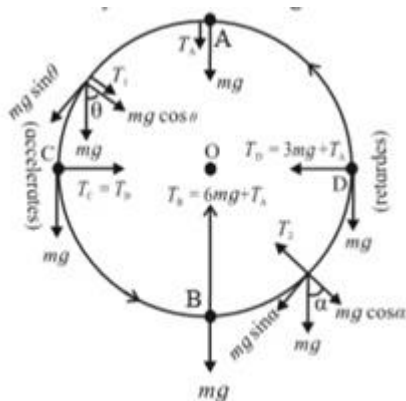


How can one find the Planck's constant from the plot?

- 175) What are eddy currents?
- 176) Name the material of the wire of Meter Bridge.
- 177) State the conditions under which beats are formed.
- 178) Name an application where superconducting magnets are used.
- 179) Why do the equipotential surfaces do not intersect with each other?
- 180) On which factors does the wavelength of light emitted by a LED depend?
- 181) How magnetic moment and magnetic field are align to each other to form a torque?
- 182) Which method of biasing is used for operating transistor as an amplifier?
- 183) What is inductive reactance?
- 184) Why GaAs is most commonly used in making of a solar cell?
- 185) What is a photosensitive surface?
- 186) The maximum velocity of a particle executing S.H.M. is 12.56 cm/s. Find the amplitude of oscillation if the period of oscillation is 8 s.
- 187) A particle executes S.H.M. with an amplitude  $A$ . What is the position of the particle in terms of  $A$ , where the kinetic energy is equal to the potential energy?
- 188) Observe the diagram and state the principle on which it is based?

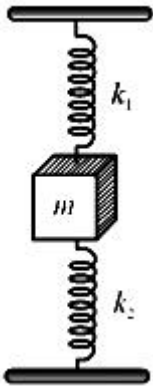


- 189) What is the importance of a radial magnetic in moving coil galvanometer?
- 190) Define potential gradient. State its SI unit.
- 191) Equal number of molecules of hydrogen and oxygen are contained in a vessel at one atmosphere pressure. What is the ratio of the collision frequency of hydrogen molecules to the of oxygen molecules on the container?
- 192) What is the unit of mutual inductance?
- 193) Diagrammatically represent the flow of heat from the system to the surrounding.
- 194) What is a galvanometer?
- 195) Define equator of a dipole.
- 196) How are the work done and potential energy of a system related?
- 197) How is radial magnetic field produced in a moving coil galvanometer?
- 198) Which type of magnets are used to prepare high magnetic fields of the order of few tesla?
- 199) The forces acting on a particle in vertical circular motion is shown in the figure given below. What is the relation between the minimum velocities of the particle at point C and D?



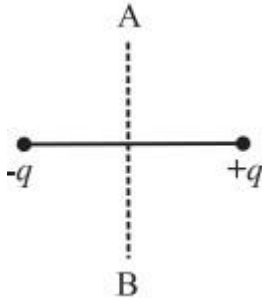
- 200) Define Lorentz Force.
- 201) A wave is represented by an equation  $y = A \sin (Bx + Ct)$ . Given that the constants A, B and C are positive, can you tell in which direction the wave is moving?
- 202) What is the time variation of emf generated by an AC generator?
- 203) Name the two conservation laws implied in Kirchhoff's laws for electric circuits.
- 204) What is the effect on the interference fringes in a Young's double slit experiment if the screen is moved away from the plane of the slits?
- 205) How many resistors are combined to form a whetstone's bridge?
- 206) Find the terminal speed of an uncharged drop of radius  $1.0 \times 10^{-5}$  m and density  $1.2 \times 10^3$  kg m<sup>-3</sup> in Millikan's oil drop experiment? (Take viscosity of air =  $1.8 \times 10^{-5}$  Pas and do not consider the buoyancy on the drop because of air).
- 207) A straight conductor of length 0.4m is moving with a speed of 7m/s perpendicular to the direction of a uniform magnetic field of 50 T. what will be the emf induced across its ends?
- 208) Observe the diagram and state the equivalent spring constant for the given arrangement.





- 209) What is fundamental note and overtone?
- 210) The root mean square speeds of the molecules of a given mass of a gas is  $100\text{ms}^{-1}$  at  $27^\circ\text{C}$  and 1.00 atmospheric pressure. What will be the root mean square speeds of the molecules of the gas at  $127^\circ\text{C}$  and 2.0 atmospheric pressure?
- 211) If the difference between the radii of the two spheres of a spherical capacitor is increased, state whether the capacitance will increase or decrease.
- 212) The current through a wire changes with time according to the equation  $I = t$ . What is the correct value of the rms current within the time interval  $t = 2\text{ s}$  to  $t = 4\text{ s}$ ?
- 213) What do you mean by Curie temperature?
- 214) What is the phase relation between current and voltage in a purely resistive circuit?
- 215) Give the mathematical statement of the first law of thermodynamics.
- 216) What is the purpose of a filter circuit?
- 217) What are matter waves?
- 218) A motor cyclist takes horizontal circles inside the cylindrical wall of a well of inner radius 5 m. The coefficient of static friction between the tyres and the wall is 0.3. Calculate the minimum speed necessary to perform this stunt.  
(Use  $g = 10\text{ m/s}^2$ )
- 219) The speeds of a particle performing linear S.H.M. are 10 cm/s and 5 cm/s at respective displacements of 5 cm and 10 cm. Find its amplitude.
- 220) Define normal atmospheric pressure.
- 221) The voltage in an ac circuit is represented by the equation,  $V = 220\sqrt{2} \sin(314t - \phi)$ , calculate RMS value of the voltage.
- 222) On what factors the internal resistance of a cell depends?
- 223) What is Mayer's relation?
- 224) What is the behavior of ferromagnetic material when placed in an external magnetic field?
- 225) 50 J of work is done on a gas and the gas loses 150 J of heat to the surrounding. What is the change in the internal energy?
- 226) A long straight wire carries a current of 35A. What is the field B at a point 20cm from the wire?
- 227) How a galvanometer is different from ammeter?
- 228) Name the instrument which has a shunt connected across a galvanometer.
- 229) Name a device used for measuring internal resistance of a secondary cell.
- 230) An electric dipole consists of two opposite charges each of magnitude  $2\text{ }\mu\text{C}$  separated by 1 cm. The dipole is placed in an external electric field of  $10^5\text{ N C}^{-1}$ . What is the maximum torque exerted by the field on the dipole?
- 231) State the characteristics of circular motion?
- 232) Does the period of a positive ion in cyclotron depend on radius of Dees?

- 233) The mercury in Torricelli's barometer was replaced with French wine of density  $984 \text{ kg m}^{-3}$ . Calculate the height of the wine column for normal atmospheric pressure.
- 234) Why the average value of AC over a complete cycle has no value?
- 235) Define surface tension.
- 236) In Young's double slit experiment what will we observe on the screen when white light is incident on the slits but one slit is covered with a red filter and the other with a violet filter? Give reasons for your answer.
- 237) A charge  $q$  is moved from a point A above a dipole of dipole moment  $p$  to a point B below the dipole in equatorial plane without acceleration. Find the work done in this process.



- 238) Two magnets with the same dimensions and mass, but of magnetic moments  $\mu_1 = 200 \text{ A m}^2$  and  $\mu_2 = 100 \text{ A m}^2$  are jointly suspended in the earth's magnetic field so as to perform angular oscillations in a horizontal plane. When their like poles are joined together, the period of their angular S.H.M. is 5 s. Find the period of angular S.H.M. when their unlike poles are joined together.
- 239) A rectangular coil of area  $50 \text{ cm}^2$  and 100 turns is placed perpendicular to a magnetic field of  $10^{-2} \text{ Wb m}^{-2}$ . Find the flux linked with the coil.
- 240) What is the condition that only interference is observed in double slit experiment, diffraction is not?
- 241) Find the length of an open organ pipe if a tuning fork of frequency 480 is in resonance with it?
- 242) State the condition of coherence.
- 243) What is electrostatic shielding?
- 244) What is the ratio of the fringe width for bright and dark fringes in Young's double slit experiment?
- 245) Which material is used to prepare permanent magnets?
- 246) Why are coherent sources required to create interference of light?
- 247) A gas starts with 200 J of internal energy. While you add 170 J of heat to the gas, the gas does 70 J of work. What is the final internal energy of the gas?
- 248) Draw the truth table for the logic gate which acts as an inverter.
- 249) A Proton and an  $\alpha$ -particle have the same de Broglie wavelength. Which other quantity is same for both of them?
- 250) Give an example of some familiar process in which heat is added to an object, without changing its temperature.
- 251) Out of AC and DC signals, which is easily passed through an inductor and which is blocked by the inductor?

----- All the Best -----

**Q.1 Answer the following very short questions:**

**251**

- 1) Ans. The Zeroth Law of Thermodynamics states that the systems in thermal equilibrium are at the same temperature.
- 2) Ans. Resolving power of an optical instrument is reciprocal to limit resolution
- 3) Ans. (i) It should have high retentivity so that it remains magnetized in the absence of the magnetizing field.  
(ii) It should have high coercivity so that it does not get demagnetized easily
- 4) Ans. Given:

The maximum acceleration,  $a_{\max} = 0.64 \text{ m/s}^2$

The maximum speed,  $v_{\max} = 0.16 \text{ m/s}$

Now,

$$\frac{a_{\max}}{v_{\max}} = \frac{A\omega^2}{A\omega} = \omega = \frac{2\pi}{T}$$

Substituting the values,

$$\frac{0.64}{0.16} = \frac{2\pi}{T}$$

$$\therefore T = 1.57 \text{ s}$$

- 5) Ans. Self inductance of an air core coil depends on the number of turns in the coil and its radius.
- 6) Ans. Work (W) = Area of the triangle A-B-C  
 $W = \frac{1}{2} (20-10)(6 \times 10^5 - 2 \times 10^5)$   
 $W = \frac{1}{2} (10)(4 \times 10^5)$   
 $W = (5)(4 \times 10^5)$   
 $W = 2100$
- 7) Ans. Given;  
 $r = 2 \text{ m}$   
velocity of the stone,  $v = \sqrt{3rg}$   
or  $v = \sqrt{3 \times 2 \times 9.8} = 7.668 \text{ m/s}$
- 8) Ans. Moving coil galvanometer is used to detect the presence of small electric current and to give its direction.
- 9) Ans. The electrostatic potential energy is zero when bar magnet is aligned perpendicular to the direction of the magnetic field.
- 10) Ans. The phaser diagram represents a purely capacitive circuit as the current leads voltage by  $90^\circ$ .
- 11) Ans. During regulation action of a Zener diode, the current through the series resistance ( $R_s$ ) changes as well as the resistance offered by the Zener changes.
- 12) Ans. Plane of polarisation is perpendicular to plane of vibration.
- 13) Ans. (i) The width of depletion layer decreases when the p-n junction is forward biased.  
(ii) The width of depletion layer increases when the p-n junction is reverse biased.
- 14) Ans. The ionization energy of an atom is the minimum amount of energy required to be given to an electron in the ground state of that atom to set the electron free.
- 15) Ans. An alternating current flows is induced in the closed coil due to change in magnetic flux linked with the it.

16) Ans. The maximum stress the structure can handle,

$$P = 10^{10} \text{ Pa}$$

Depth of the sea,  $d = 5 \text{ km} = 5 \times 10^3 \text{ m}$

Density of water,  $\rho = 10^3 \text{ kg/m}^3$

Acceleration due to gravity,  $g = 9.8 \text{ m/s}^2$

We know:

The pressure exerted by the seawater at

$$\begin{aligned} \text{depth, } d &= \rho dg \\ &= 10^3 \times 5 \times 10^3 \times 9.8 \\ &= 4.9 \times 10^7 \text{ Pa} \end{aligned}$$

As the sea exerts a pressure lesser than the maximum stress the structure can handle, the structure can survive on the oil well in the sea.

17) Ans. There is a phase change of  $\pi$  radian on reflection of transverse wave from denser medium.

18) Ans. Degrees of freedom of a system are defined as the total number of coordinates or independent quantities required to describe the position and configuration of the C system completely.

19) Ans. Given,

$$A = 3 \text{ cm}^2 = 3 \times 10^{-4} \text{ m}^2$$

$$d = 4 \text{ mm} = 4 \times 10^{-3} \text{ m}$$

$$\begin{aligned} \text{Capacitance} &= \frac{\epsilon_0 A}{d} \\ &= \frac{8.85 \times 10^{-12} \times 3 \times 10^{-4}}{4 \times 10^{-3}} \\ &= 6.64 \times 10^{-14} \text{ F} \end{aligned}$$

20) Ans. Data:

$$l = 3 \text{ cm} = 0.34 \text{ m}, v = 340 \text{ m/s}$$

Fundamental frequency of pipe open at both ends is

$$n = \frac{v}{2l} = \frac{340}{2 \times 0.34} = 500 \text{ Hz}$$

21) Ans. The ferromagnetism depends on the temperature.

22) Ans. At point B, the resultant force can be expressed as:

$$T_B - mg = \frac{mv_B^2}{r}$$

23) Ans. The quantity in rotational dynamics analogous to linear momentum is angular momentum.

24) Ans. The mathematical statement that provides the relationship between the input and the output of a logic gate is called a Boolean expression.

25) Ans. An increase in intensity means increase in number of photons and thus, increase in photoelectric current.

26) Ans. No positively charged particles are emitted by the atoms, because the positive charge is present in the nucleus only. The nucleus has a large mass and is thus not get affected when force is applied on the atom.

27) Ans. Non-harmonic oscillation is that oscillation which cannot be expressed in terms of single harmonic function. It may be a combination of two or more harmonic oscillations such as  $x = a \sin \omega t + b \sin 2 \omega t$ , etc.

28) Ans. Pascal's law states that the pressure applied at any point of an enclosed fluid at rest is transmitted

equally and undiminished to every point of the fluid and also on the walls of the container, provided the effect of gravity is neglected.

29) Ans. No the point will be bright as the path difference is even multiple of  $\lambda/2$

30) Ans. There is no current through the cell while it is giving the balance point.

31) Ans. The maximum value of the adiabatic ratio is  $5/3$ , for monatomic gases.

32) Ans. The net dipole moment of bulk materials is zero.

33) Ans. A process in which the thermodynamic state of a system is changed is known as a thermodynamic process.

34) Ans. Glancing angle,  $\theta = 90^\circ - \frac{\phi}{2}$   
or  $\theta = 90^\circ - \frac{52^\circ}{2} = 64^\circ$

35) Ans. Photo cell is a device which uses photoelectric effect and converts light energy into electrical energy.

36) Ans. Dielectrics are insulators which can be used to store electrical energy.

37) Ans. Given,

$$q = 5 \mu\text{C} = 5 \times 10^{-6} \text{ C}$$

$$V = 5 \times 10^5 \text{ V}$$

$$W = qV$$

$$= 5 \times 10^{-6} \text{ C} \times 5 \times 10^5 \text{ V}$$

$$= 2.5 \text{ J}$$

38) Ans. A motion in which a particle repeatedly moves to and fro along the same path is the oscillatory or vibratory motion. Every oscillatory motion is periodic but every periodic motion need not be oscillatory. Circular motion is periodic but it is not oscillatory.

39) Ans. The velocity at the top most point must be greater than the critical velocity, so that the normal force and the weight string downwards at the top most point are balanced by the centripetal force.

40) Ans. Yes it can, but only when it moves parallel or anti parallel to the field.

41) Ans. The drop of potential per unit length of potentiometer wire is called potential gradient. The SI unit of potential gradient is  $\text{voltm}^{-1}$ .

42) Ans. Current through pure inductor or ideal capacitor which consumes no power for its maintenances, in the circuit is called idle current or wattless current.

43) Ans. It is a resistance connected in parallel with an electrical instrument to provide an alternative path to electric current.

44) Ans. As the source slit width increases, the fringe pattern gets less and less sharp.

45) Ans. Here,  $G = 500 \text{ ohm}$  and  $R_{eq} = 21 \text{ ohm}$

$$\therefore S = \frac{GR_{eq}}{G - R_{eq}}$$

$$\therefore S = \frac{500 \times 21}{500 - 21}$$

$$\therefore S = 21.92 \text{ ohm}$$

46) Ans. The orbits in which the electrons do not emit any radiation during their motion are known as stable orbits.

47) Ans. Co-efficient of self induction of a coil is defined as the e.m.f induced in the coil per unit rate of change of current in the same coil.

48) Ans. Given:

mass of the body,  $m = 0.8 \text{ kg}$

Restoring force,  $f = 0.2 \text{ N}$

Displacement,  $x = 4 \text{ cm} = 0.04 \text{ m}$

The spring constant,  $k = \frac{f}{x} = \frac{0.2}{0.04} = 5 \text{ N/m}$

Period,  $T = \frac{2\pi}{\omega}$

or  $T = 2\pi \sqrt{\frac{m}{k}}$

$\therefore T = 7.85 \text{ s}$

49) Ans. Applications of beats:

(i) The phenomenon of beats is used for matching the frequencies of different musical instruments by artists.

(ii) The phenomenon of beats is used to determine an unknown frequency.

50) Ans. The magnetic force per unit length is

$$\frac{F}{L} = IB \sin \theta = 8 \times 0.15 \times \sin 30 = 0.6 \text{ newton m}^{-1}$$

51) Ans. A equipotential surfaces of single point charge are concentric spherical surfaces centered at the charge and for a line charge, the shape of equipotential surface is cylindrical.

52) Ans. One atomic mass unit is equal to 1/12th of the mass of a neutral carbon atom having atomic number 12, in its lowest electronic state.  $1 \text{ u} = 1.6605402 \times 10^{-27} \text{ kg}$ .

53) Ans. The electromagnets are used in an electric bell, loud speakers, and circuit breakers and also in research laboratories.

54) Ans. 
$$W = nRT \ln \frac{V_2}{V_1}$$
$$= 22.4 \times \ln 2$$
$$= 15.68 \text{ J}$$

55) Ans. Pressure, temperature and density are intensive variables.

56) Ans. The I-V characteristics of a solar cell is drawn in the fourth quadrant because a solar cell does not draw current but supplies the same to the load.

57) Ans. No Microwave cannot be used for photoelectric effect due to low energy photons.

58) Ans. Use of mercury is not advised in a laboratory because mercury vapors are hazardous for life and for environment.

59) Ans. Linear S.H.M. is defined as the linear periodic motion of a body, in which force (or acceleration) is always directed towards the mean position and its magnitude is proportional to the displacement from the mean position.

60) Ans. Viscosity is that property of fluid, by virtue of which, the relative motion between different layers of a fluid experience a dragging force.

61) Ans. A gas obeying the equation of state  $PV = nRT$  at all pressures, and temperatures is an ideal gas.

62) Ans. The length of the wire used in Meter Bridge is 1 metre.

63) Ans. In an ideal gas intermolecular interactions are absent.

64) Ans. It is an electrical apparatus based on the principle of Whetstone's bridge.

65) Ans. The first law of the thermodynamics gives the mathematical relation between heat and work.

66) Ans. An inductor cannot reduce DC voltages as for DC voltage the frequency is zero, hence the inductive reactance is also zero.



67) Ans. The phase difference between two points on the same wave front is zero.

68) Ans. For a given conical pendulum the length of the pendulum is fixed. So, the time period and the frequency depend in the angular displacement of the pendulum.

69) Ans. 
$$\theta = \tan^{-1} \left( \frac{v^2}{rg} \right)$$

where,  $\theta$  is the banking angle

$v$  is the velocity of the vehicle

$r$  is the radius of the circular road

$g$  is the acceleration due to gravity

70) Ans. Inductance in electrical circuits plays the same role as inertia in mechanics.

71) Ans. The moment of inertia of a uniform rod about an axis perpendicular to the length and passing through one end is

$$\frac{1}{3}MR^2.$$

72) Ans. The magnetic field at the centre of the coil is given by

$$B = N \frac{\mu_0 I}{2R}$$
$$= \frac{100 \times 4\pi \times 10^{-7} \times 0.40}{2 \times 8 \times 10^{-2}} = 3.14 \times 10^{-4} \text{ tesla}$$

73) Ans. By faraday's law  $\varepsilon = -N \frac{d\phi}{dt}$

$$\varepsilon = \frac{12-10}{0.02} = 50 \text{ volt}$$

74) Ans. The current in the inductor coil is given by  $I = \frac{V}{X_L} = \frac{V}{2\pi\nu L}$

Since frequency  $\nu$  in the two cases is different, hence the current in two cases will be different.

75) Ans. Inner orbits are completely filled thus do not contribute to the total magnetic moment.

76) Ans. For a destructive interference, phase difference between the waves is  $(2n+1)\pi$

77) Ans. Mean square speed is directly proportional to the square root of temperature. So, if the temperature of the gas increases, the mean square speed of the molecules of the gas will also increase.

78) Ans. According Plum-pudding model an atom is a sphere having a uniform positive charge in which electrons are embedded.

79) Ans. The phenomenon of producing an induced e.m.f in a conductor or conducting coil due to changing magnetic flux is called electromagnetic induction.

80) Ans. The main reason why humans get electric shocks is that human body being a good conductor allows a resistance free path for the current to flow from the wire to our body.

81) Ans. There is no change of phase during this reflection of longitudinal wave reflects from a denser medium.

82) Ans. The general expression of displacement of a particle executing S.H.M is  $x = A \sin(\omega t + \phi)$

Now, velocity is given as:

$$v = \frac{dx}{dt}$$

Using the value of  $x$  as  $A \sin(\omega t + \phi)$ , we get

$$v = \frac{d(A \sin(\omega t + \phi))}{dt}$$

$$\text{or } v = A\omega \cos(\omega t + \phi)$$

83) Ans. An equipotential surface is that surface, at every point of which the electric potential is the same.

84) Ans. Energy of mol of gas  $= \frac{f}{2}RT = \frac{f}{2}PV$

Where  $f$  = degree of freedom

For a monatomic gas, the degree of freedom is equal to 3, i.e.,  $f=3$

$$\therefore E = \frac{3}{2}PV$$

85) Ans. The magnet becomes stationary after rotating for a while because of restoring torque.

86) Ans. It is always connected in series with a resistance  $R$  through which the current is to be measured.

87) Ans. Two systems in thermal contact with each other are said to be in thermal equilibrium if they do not transfer heat between each other.

88) Ans. The reverse current of a photodiode depends on the intensity of the incident light.

89) Ans. The phenomenon of emission of electrons from a metal surface when radiation of appropriate frequency incident on it

90) Ans. Given:

$$r = 50 \text{ m}, v = 15 \text{ m/s}$$

Using the relation,

$$v = \sqrt{\mu r g}$$

$$\text{or } \mu = \frac{v^2}{r g} = \frac{15^2}{50 \times 9.8} = 0.459$$

91) Ans. An oscillatory motion which obeys sine and cosine functions is known as harmonic motion.

92) Ans. Given:

The maximum weight the film can support,

$$W = 2.5 \times 10^{-2} \text{ N}$$

Length of the slider,  $l = 30 \text{ cm} = 0.3 \text{ m}$

A soap film has two free surfaces.

Thus, total length  $= 2l = 2 \times 0.3 = 0.6 \text{ m}$

We know, surface tension

$$= \frac{\text{Weight}}{2l} = \frac{2.5 \times 10^{-2} \text{ N}}{0.6 \text{ m}} = 4.17 \times 10^{-2} \text{ N/m}$$

Thus the surface tension of the film

$$= 4.17 \times 10^{-2} \text{ N/m}$$

93) Ans. Atoms having the same number of protons but different number of neutrons are known as isotopes.

94) Ans. It is always connected in parallel to a resistance  $R$  through which the current is to be measured.

95) Ans. If the atoms/ molecules of a real gas are so far apart that there is practically no interatomic/ intermolecular interaction, the real gas is said to be in the ideal state.

96) Ans. Phenomenon of bending of light around corners of a small obstacle and spreading into region of geometrical shadow is called diffraction of light.

97) Ans. The science of measuring temperatures is called Thermometry.

98) Ans. Intermolecular forces are effective up to a distance of the order of few nanometer ( $10^{-9} \text{ m}$ ) in solids and liquids. Therefore, they are short range forces.

99) Ans. The difference between the absolute pressure and the atmospheric pressure is called the gauge pressure.

100) Ans. A gas enclosed in a container is characterized by its pressure, volume and, temperature. This is the macroscopic description of the gas.

101) Ans. For a gas, its state is specified by a number of physical quantities such as pressure P, temperature T, volume V, internal energy E, etc. Hence, the equation relating these quantities is known as the equation of state.

102) Ans. The peak value of an alternating current is the maximum value of the current in either direction.

103) Ans. Given:

$$n_1 = 0 \text{ rpm} = 0 \text{ rps}$$

$$n_2 = 240 \text{ rpm} = 4 \text{ rps}$$

$$t = 3 \text{ s}$$

Change in angular speed,  $\Delta\omega = \omega_2 - \omega_1$

$$\text{or } \Delta\omega = 2\pi(n_2 - n_1) = 2\pi(4 - 0) = 8\pi = 25.12 \text{ rad/s}$$

104) Ans. Soft iron core makes the field radial within the gap. It also increases the strength of the magnetic field.

105) Ans. Given,

$$V' = \frac{V}{8}$$

We know,

$$V' = \frac{V}{K}$$

Comparing,  $K = 8$

106) Ans. A moving coil ammeter or a voltmeter measure the average value of current and voltage applied across it respectively. In case of AC current and voltage the average over one complete cycle is zero, hence a moving coil ammeter or a voltmeter cannot be used to measure alternating current and voltages.

107) Ans. The principle states that when two or more waves travelling through a medium arrive at a point of the medium simultaneously, each wave produces its own displacement at that point independently of the others. Hence the resultant displacement at that point is equal to the vector sum of the displacements due to all the waves.

108) Ans. Superposition of two waves in the same phase to produce maximum intensity is known as constructive interference.

109) Ans. It is one quarter of the wavelength or  $\lambda/4$ .

110) Ans. Atoms having the same number of neutrons but different values of atomic number are known as isotones.

111) Ans. The direction of induced emf is such a direction so as to oppose the cause of change of magnet flux.

112) Ans. Electric generator works on the principle of electromagnetic induction. When the coil of electric generator rotates in a magnetic field, The magnetic field induces a current in this coil. This induced current then flows into circuit connected to the coil.

113) Ans. A stationary wave is so called because there is no propagation of energy.

114) Ans. A continuous locus of particles of medium vibrating in the same phase at any instant is known as wave front.

115) Ans. Electrostatic potential energy is the work done against the electrostatic forces to achieve a certain configuration of charges in a given system.

116) Ans. The force per unit length is given by

$$f = \frac{\mu_0 i_1 i_2}{2\pi d} = \frac{4\pi \times 10^{-7} \times 4 \times 5}{2\pi \times 4} = 10^{-6} \text{ Nm}^{-1}$$

- 117) Ans. The ratio of magnetic moment to the volume of the material is called magnetization.
- 118) Ans. Mutual inductance is defined as the magnetic flux linked through one coil due to the flow of one ampere current in the neighbouring coil.
- 119) Ans.  $W = P \Delta V$   
 $W = P (V_2 - V_1)$   
 $W = (2 \times 10^5)(15 \times 10^{-6} - 5 \times 10^{-6})$   
 $W = (2 \times 10^5)(10 \times 10^{-6}) = (2 \times 10^5)(1 \times 10^{-5})$   
 $W = 2 \text{ Joule}$
- 120) Ans. N-p-n transistor is more useful because in this the current carriers are mainly the electrons which are move faster than the holes.
- 121) Ans. The maximum value of photoelectric current is called the saturation current.
- 122) Ans. When high speed, stormy wind blows over a roof top, it causes low pressure  $p$  above the roof in accordance with the Bernoulli's principle. However, the air below the roof (i.e. inside the room) is still at the atmospheric pressure  $p_0$ . So, due to this difference in pressure, the roof is lifted up and is then blown off by the wind as shown in figure.
- 123) Ans. Phase  $\Theta = 90^\circ$  or  $\frac{\pi}{2}$  indicates that the particle is at the positive extreme position during first oscillation.  
 For the second oscillation it will be  $\Theta = (360 + 90)^\circ$  or  $\left(2\pi + \frac{\pi}{2}\right)$  and so on for the successive oscillations.
- 124) Ans. Plasma is one of the four fundamental states of matter. It consists of a gas of ions, free electrons and neutral atoms.
- 125) Ans. A real gas obeys ideal gas equation under following condition  
 i) High temperature  
 ii) Low pressure
- 126) Ans. Balance point is obtained in the middle of meter bridge wire to minimise the error involved due to contact resistances and end resistances.
- 127) Ans. -When a molecule approaches another molecule, there is a repulsive force between them, due to which the molecules behave as small hard spherical particles.  
 -This leads to elastic collisions between the molecules. Therefore, both the speed and the direction of motion of the molecules change abruptly.
- 128) Ans. The null point should be in between  $(2/3)$  rd of the length of the wire.
- 129) Ans. Anything that is not a part of the system of the thermodynamic process is its surrounding or its environment.
- 130) Ans. We can interchange the resistance box and the unknown resistance in case of a meter bridge.
- 131) Ans. Here the beat frequency  $n = n_2 - n_1 = 255 - 250 = 5 \text{ Hz}$   
 Beat period  $= 1/n = 1/5 = 0.2 \text{ sec}$
- 132) Ans. On loading the prongs of a tuning fork with wax, its frequency decreases. While on filling its prongs, frequency increases.
- 133) Ans.  $V_{\text{rms}} = (\sum V^2 / N)^{1/2}$   
 $= [(v^2 + 4v^2 + 9v^2 + 16v^2 + 25v^2) / 5]^{1/2}$   
 $= v(11)^{1/2}$
- 134) Ans. All the molecule have same kinetic energy at same temperature. So, the ratio of average kinetic energy per molecule of hydrogen and chlorine is 1:1.
- 135) Ans. The law of conservation of angular momentum states that in the absence of external unbalanced torque, the angular momentum of a system remains conserved.
- 136) Ans. Given area of the coil  $A = 10 \text{ cm}^2 = 10 \times 10^{-4} \text{ m}^2$   
 Current in the coil  $I = 2 \text{ amp}$   
 Therefore, the magnetic moment  $m = IA = 10^{-3} \times 2 = .002 \text{ amp m}^2$

- 137) Ans. An inductor allows DC to pass through it easily whereas it blocks AC of very high frequency.
- 138) Ans. When a system which has natural tendency to oscillate is driven by an energy source, whose frequency is equal to the natural frequency of the system, then the amplitude of oscillations become large and resonance is said to occur.
- 139) Ans.  $T = 500N$  and mass per unit length  

$$m = \frac{0.4 \times 10^{-2}}{0.8} \text{ kg/m}$$
 We know  $v = \sqrt{\frac{T}{m}} = \sqrt{\frac{500 \times 0.8}{0.4 \times 10^{-2}}}$
- 140) Ans. Path difference between two waves undergoing constructive interference is  $n\lambda$ .  $\lambda$  is the wave length of the interfering waves.
- 141) Ans. The fundamental frequency of vibration of a stretched string  $n \propto \sqrt{T}$   
 Hence  $\frac{n_2}{n_1} = \sqrt{\frac{T_2}{T_1}} = \sqrt{\frac{4T}{T}}$  ( $T_2 = 4T_1$ )  
 Therefore  $n_2 = 2n_1 = 2 \times 200 = 400\text{Hz}$
- 142) Ans. The total number of nucleons in the nucleus is called the mass number.
- 143) Ans.  $1 \text{ henry} = \frac{1 \text{ weber}}{1 \text{ ampere}}$
- 144) Ans. Direction of angular velocity,  $\omega$  is always along the axis of rotation. The direction of  $\omega$  can be found using the right-hand thumb rule. The right hand thumb rule states that to know the direction of  $\omega$ , curl the fingers of the right hand and along the sense of rotation, with the thumb outstretched. The outstretched thumb then gives the direction of  $\omega$ .
- 145) Ans. The equation of a simple harmonic progressive wave, travelling in the positive x-direction is represented as  $y = A \sin(kx + \omega t)$  where A is the amplitude of the wave,  $k = 2\pi/\lambda$  is the wave number,  $\lambda$  and  $\omega$  are the wavelength and the angular frequency of the wave.
- 146) Ans. The self inductance of the coil is directly proportional to the square of the number of turns of the coil. Mathematically  $L \propto N^2$
- 147) Ans. One joule is the energy stored in moving a charge of 1C through a potential difference of 1 volt.
- 148) Ans. The phenomenon of redistribution of energy in a medium due to the superposition of two light waves from two coherent sources is called interference of light.
- 149) Ans. When the electric dipole is kept in the electric field then the energy stored is the electrostatic potential energy.
- 150) Ans. They cannot keep a constant phase difference.
- 151) Ans. It is a long solenoid bent into the form of a circle.
- 152) Ans. The sensitivity of the photodiode can be increased by minimizing the dark current.
- 153) Ans.  $\lambda \propto \frac{1}{p} \propto \frac{1}{v} \propto \frac{1}{\sqrt{H}}$
- 154) Ans. Second law of thermodynamics sets limits on the efficiency of a heat engine.
- 155) Ans. The number of oscillations performed by a particle performing S.H.M. per unit time is called the frequency of S.H.M.
- 156) Ans. The surface tension of oil and paint is kept low, so that they can be spread over a large surface area.



157) Ans. Given,

$$C_A = \frac{\epsilon_0 A}{d}, C_B = \frac{K\epsilon_0 A}{d} = \frac{4\epsilon_0 A}{d}$$

$$\text{or } C_B = 4C_A$$

$$\frac{1}{C_{eq}} = \frac{1}{C_A} = \frac{1}{C_B}$$

$$\text{or } \frac{1}{4} = \frac{1}{C_A} = \frac{1}{4C_A}$$

$$\text{or } C_A = 5 \mu\text{F and } C_B = 20 \mu\text{F}$$

158) Ans. There will be no change in the null position.

159) Ans. The average distance traversed by a molecule with constant velocity between two successive collisions is known as the mean free path.

160) Ans. At  $x = \frac{\pm A}{\sqrt{2}}$ ,

$$\text{P.E.} = \frac{1}{2} kx^2 = \frac{1}{4} \left( \frac{1}{2} kA^2 \right) = \frac{E}{4}$$

$$\therefore \text{K.E.} = 3(\text{P.E.})$$

Thus at  $x = \frac{\pm A}{\sqrt{2}}$ , the energy is 25% potential and 75% kinetic.

161) Ans. There are three types of thermodynamic systems, i.e. open, closed and isolated system.

162) Ans. (i) Soft iron has large permeability ( $>1000$ ) and small amount of retaining magnetization.

(ii) Hence, these are the properties of soft iron which makes it useful for preparing electromagnet.

163) Ans. Due to low frequency of red light it is not always possible to see the photoelectric effect. Only for metals having threshold frequency less than or equal to red light photoelectric effect is seen.

164) Ans. If the currents are in the same direction, the force is attractive. If the currents are in the opposite directions, the force is repulsive.

165) Ans. The density of a nucleus does not depend on the atomic number of the nucleus and this is the reason why the density of the nucleus is the same for all nuclei.

166) Ans. The masses of the three particles in this unit are:

i.  $m_e = 0.511 \text{ MeV}/c^2$

ii.  $m_p = 938.28 \text{ MeV}/c^2$

iii.  $m_n = 939.57 \text{ MeV}/c^2$

167) Ans. The upper limit of the speed of the vehicle is given by the relation:

$$V_{\max} = \sqrt{rg}$$

168) Ans. Yes, magnetic field can change the direction of velocity but can't change its magnitude.

169) Ans. Yes, as  $\mu = \tan i_p$  and  $\mu \propto \frac{1}{\lambda^2}$

Where  $\mu$  refractive index of the light,  $\lambda$  is the wavelength and  $i_p$  is the angle of polarisation

170) Ans. A rotating vector that represents a quantity varying sinusoidally with time is called a phasor.



171) Ans. Given:

$$\text{Radius of the heel, } r = \frac{d}{2} = 0.004\text{m}$$

$$\text{Mass of the lady, } m = 40 \text{ kg}$$

$$\text{Area of the heel, } A = \pi r^2 = \pi (0.004)^2 = 5.024 \times 10^{-5} \text{ m}^2$$

Force on the floor due to the heel:

$$F = mg = 40 \times 9.8 = 392 \text{ N}$$

Pressure exerted by the heel on the floor:

$$P = \frac{392 \text{ N}}{5.024 \times 10^{-5}} = 7.8 \times 10^6 \text{ Nm}^{-2}$$

- 172) Ans. Frequency of the monochromatic light remains constant when it travels from one medium to another.
- 173) Ans. Rest mass of a photon is zero.
- 174) Ans. The product of slope of the line and charge of electron gives the value of Planck's constant.
- 175) Ans. Eddy currents are the currents that flow a solid conductor due to change in magnetic flux linked through it.
- 176) Ans. The material used is manganite.
- 177) Ans. Two sounds waves should have nearly equal amplitude and slightly different frequency. This is the condition for formation of beats.
- 178) Ans. Superconducting magnets are used in Nuclear Magnetic Spectroscopy.
- 179) Ans. Equipotential surfaces do not intersect each other as it gives two directions of electric fields at intersecting point which is not possible.
- 180) Ans. The wavelength of light emitted by LED depends on the proportions of semiconductor used in the fabrication of the LED.
- 181) Ans. The magnetic moment and magnetic field are perpendicular to each other to form a torque.
- 182) Ans. For transistor operating as an amplifier, the emitter-base junction is forward biased while collector-base junction is reverse biased.
- 183) Ans. The opposing nature of inductor to the alternating current is called inductive reactance.
- 184) Ans. The absorption coefficient of GaAs is very high, that is why it is most commonly used in making of a solar cell.
- 185) Ans. The surface which emits electrons, when illuminated with appropriate radiation, is known as a photosensitive surface.

186) Ans. Given:

maximum velocity,  $v_{\max} = 12.56 \text{ cm/s} = 4\pi$

time period,  $T = 8 \text{ s}$

we know that;

$$v_{\max} = A\omega$$

$$\text{or } v_{\max} = A \frac{2\pi}{T}$$

Substituting the values,

$$4\pi = A \frac{2\pi}{8}$$

$$\text{or } A = 16 \text{ cm}$$

187) Ans. Given;

$$\text{K.E.} = \text{P.E.}$$

Now writing the formula for each;

$$\frac{1}{2} m\omega^2(A^2 - x^2) = \frac{1}{2} m\omega^2 x^2$$

$$\therefore x = \frac{\pm A}{\sqrt{2}}$$

Thus at  $x = \frac{\pm A}{\sqrt{2}}$ , the K.E. = P.E. =  $\frac{E}{2}$  for a particle performing linear S.H.M.

188) Ans. The shape of cross section of wings of an aero plane is as shown in figure. The dynamic lift of the aero plane is based on the Bernoulli's principle.

189) Ans. In a radial magnetic field, magnetic torque remains constant for all positions of the coil.

190) Ans. The drop of potential per unit length of potentiometer wire is called potential gradient. The SI unit of potential gradient is volt/m.

191) Ans. Let  $n_1$  be the collision frequency for hydrogen and  $n_2$  be the collision frequency for oxygen.

$$n_1 = V_{\text{rms}}/2L$$

$$n_2 = V_{\text{rms}}/2L$$

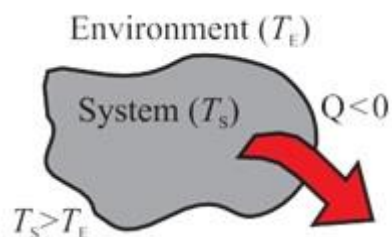
$$n_1/n_2 = V_{\text{rms}} \text{ of Hydrogen} / V_{\text{rms}} \text{ of oxygen}$$

$$V_{\text{rms}} \text{ of Hydrogen} / V_{\text{rms}} \text{ of oxygen} = (M_O/M_H)^{1/2}$$

$$\text{So } n_1/n_2 = 4:1$$

192) Ans. The unit of mutual inductance is Henry.

193) Ans.



194) Ans. A galvanometer is a device used to detect weak electric currents in a circuit.

195) Ans. A straight line drawn perpendicular to the axis and passing through centre O of the electric dipole is called equator of dipole.

196) Ans. The work done against an electrostatic force = Increase in the potential energy of the system.

197) Ans. It is produced due to cylindrical pole pieces and soft iron core.

198) Ans. Superconducting magnets are used to prepare high magnetic fields of the order of few tesla.

199) Ans. The minimum velocities of the particle at point C and D are equal.

200) Ans. It is the total force acting on a charged particle moving in the combined effect of electric and

magnetic fields. It is given by

$$\vec{F} = \vec{F}_E + \vec{F}_m = q[\vec{E} + (\vec{v} \times \vec{B})]$$

201) Ans. The wave is moving in direction of negative X-axis.

202) Ans. The emf generated by an AC generator can be represented as:

$$e = e_0 \sin \omega t$$

Where  $e_0$  is the peak value of emf and  $\omega$  is the angular frequency of rotation of the coil in the AC generator.

203) Ans. The two conservation laws are law of conservation of charge and law of conservation of energy.

204) Ans. The actual linear separation of the fringes increases in proportion to the distance of the screen from the plane of the two slit.

205) Ans. Whetstone's bridge is an arrangement of four resistances P, Q, R and S. These are connected to form a quadrilateral.

206) Ans. Given:

Acceleration due to gravity,  $g = 9.8 \text{ m/s}^2$

Radius of the uncharged drop,

$$r = 1.0 \times 10^{-5} \text{ m}$$

Density of the uncharged drop,

$$\rho = 1.2 \times 10^3 \text{ kg m}^{-3}$$

Viscosity of air,  $\eta = 1.8 \times 10^{-5} \text{ Pas}$

We consider the density of air to be zero in order to neglect the buoyancy of air.

Therefore terminal velocity ( $v$ ) is :

$$v = \frac{2r^2 g \rho}{9\eta}$$

$$\text{or } v = \frac{2(1.0 \times 10^{-5})^2 \times 9.8 \times 1.2 \times 10^3}{9 \times 1.8 \times 10^{-5}} \\ = 1.45 \times 10^{-2} \text{ m/s}$$

207) Ans. the emf induce is given by  $\varepsilon = Blv$

$$\text{So } \varepsilon = 50 \times 0.4 \times 7 = 140 \text{ volt}$$

208) Ans. The springs with spring constants  $k_1$  and  $k_2$  are having a parallel arrangement. Thus the equivalent spring constant is  $k = k_1 + k_2$ .

209) Ans. (i) The fundamental note is the lowest frequency that can be produced by the source of sound.

(ii) The higher frequency that can be produced by the source are called overtones.

210) Ans. We know that for a given mass of a gas

$$v_{rms} = \sqrt{\frac{3RT}{M}}$$

Clearly for a given gas,

$v_{rms} \propto \sqrt{T}$ , as R, M are constants.

Hence,

$$\frac{(v_{rms})_1}{(v_{rms})_2} = \sqrt{\frac{T_1}{T_2}}$$

Given,

$$(v_{rms})_1 = 100 \text{ m/s}$$

$$T_1 = 27^\circ\text{C} = 27 + 273 = 300\text{K}$$

$$T_2 = 127^\circ\text{C} = 127 + 273 = 400\text{K}$$

Substituting the values,

$$\frac{100}{(v_{rms})_2} = \sqrt{\frac{300}{400}}$$

$$\text{or } (v_{rms})_2 = \frac{200}{\sqrt{3}} \text{ m/s}$$

211) Ans. For a spherical capacitor  $C = 4\pi\epsilon_0 (ab/b - a)$

Where,  $(b - a)$  is the difference between radii of spheres.

As  $(b - a)$  increases, due to increase relation with capacitance (C) capacitance of capacitor will decrease.

212) Ans.

$$I_{rms} = \left( \frac{1}{4 - 2} \int_{t=2}^{t=4} I^2 dt \right)^{1/2}$$
$$= \left( \frac{1}{2} \int_{t=2}^{t=4} t dt \right)^{1/2}$$
$$= \sqrt{3} \text{ A}$$

213) Ans. The temperature at which a ferromagnetic material transforms into a paramagnetic substance is called Curie temperature of the material.

214) Ans. There is no phase difference between voltage and current in a purely resistive circuit.

215) Ans.  $\Delta U = Q - W$

This is the mathematical statement of the first law of thermodynamics.

216) Ans. The output of the rectifier contains some AC component. This AC component in the DC output of a rectifier is called ripple. It is removed by using a filter circuit.

217) Ans. Waves associated with the material particles are known as matter waves.

218) Ans.

$$v_{min} = \sqrt{\frac{rg}{\mu_s}} = \sqrt{\frac{5 \times 10}{0.3}} = 12.91 \text{ m/s}$$

219) Ans.

$$v = \omega \sqrt{A^2 - x^2}$$

$$\text{So, } \frac{10}{5} = \frac{\omega \sqrt{A^2 - 5^2}}{\omega \sqrt{A^2 - 10^2}}$$

$$\text{or } 2 = \frac{\sqrt{A^2 - 5^2}}{\sqrt{A^2 - 10^2}}$$

$$\therefore A = 11.9 \text{ cm}$$

220) Ans. The atmospheric pressure at sea level is called normal atmospheric pressure.

221) Ans.  $V_{rms} = \frac{V_{peak}}{\sqrt{2}} = 220 \text{ V}$

222) Ans. The internal resistance of a cell depends on the nature of electrolyte and current drawn from the cell.

223) Ans. Mayer's relation gives an expression that connects the specific heat at constant temperature and the specific heat at constant volume.

$$C_p - C_v = R$$

224) Ans. The behavior of ferromagnetic material when placed in an external field is non-linear.

225) Ans. Using the First Law of Thermodynamics:

$$\Delta U = -150 \text{ J} + 50 \text{ J} = -100 \text{ J}$$

226) Ans. Current in the wire  $I = 35 \text{ A}$

$$\text{Distance } d = 20 \text{ cm} = 0.2 \text{ m}$$

$$\begin{aligned} \text{The field B at the point } B &= \frac{\mu_0 i}{2\pi d} = \frac{4\pi \times 10^{-7} \times 35}{2\pi \times 0.2} \\ &= 35 \times 10^{-6} \text{ tesla} \end{aligned}$$

227) Ans. It is a current measuring instrument. It is always connected in series with a resistance R through which the current is to be measured.

228) Ans. Ammeter

229) Ans. Potentiometer

230) Ans. Given,

$$q = 2 \mu\text{C} = 2 \times 10^{-6} \text{ C}$$

$$d = 1 \text{ cm} = 10^{-2} \text{ m}$$

$$E = 10^5 \text{ NC}^{-1}$$

$$\text{Maximum torque} = pE = qdE$$

$$= 2 \times 10^{-6} \text{ C} \times 10^{-2} \text{ m} \times 10^5 \text{ NC}^{-1}$$

$$= 2 \times 10^{-2} \text{ Nm}$$

231) Ans. A circular motion has the following characteristics:

a. An accelerated motion: As the direction of velocity changes at every instant, circular motion is an accelerated motion.

b. A periodic motion: The particle repeats its path along the same trajectory during circular motion. Thus, the motion is periodic.

232) Ans. No, it is independent of radius of dees and is same for all ions with same mass and same charge.

$$T = \frac{2\pi m}{qB}$$

233) Ans. We know:

Density of mercury,  $\rho_1 = 13.6 \times 10^3 \text{ kg/m}^3$

Height of the mercury column,  $h_1 = 0.76 \text{ m}$

Density of French wine,  $\rho_2 = 984 \text{ kg/m}^3$

Let the height of the French wine column =  $h_2$

Acceleration due to gravity,  $g = 9.8 \text{ m/s}^2$

We know that:

Pressure in the mercury column =

Pressure in the wine column

$$\rho_1 h_1 g = \rho_2 h_2 g$$

$$\text{or } h_2 = \frac{13.6 \times 10^3 \times 0.76}{984} = 10.5 \text{ m}$$

234) Ans. The average over a full cycle is always zero as the average value of  $\sin \omega t$  over a complete cycle is zero. So, the mean value of AC is defined as the average over half cycle.

235) Ans. Surface tension is defined as, the tangential force acting per unit length on both sides of an imaginary line drawn on the free surface of liquid.

236) Ans. As the light from two sources is of different wave length, so the two sources are no longer coherent. Thus no sustained interference pattern will be obtained. There will be uniform illumination of light on the screen.

237) Ans. 1. Displacement of charge is along equatorial line of dipole (AB) where potential is zero throughout.

2. As work done,  $W = qV$ ,  
work done in the process is zero.

238) Ans. Given:

$$\mu_1 = 200 \text{ A m}^2$$

$$\mu_2 = 100 \text{ A m}^2$$

$$T_1 = 5 \text{ s}$$

We know that:

$$T = 2\pi \sqrt{\frac{I}{\mu B}}$$

With like poles together, the effective magnetic moment is  $\mu_1 + \mu_2$ .

Therefore,

$$T_1 = 2\pi \sqrt{\frac{I}{(\mu_1 + \mu_2) B}} \dots\dots\dots(i)$$

With unlike poles together, the effective magnetic moment is  $\mu_1 - \mu_2$ .

Therefore,

$$T_2 = 2\pi \sqrt{\frac{I}{(\mu_1 - \mu_2) B}} \dots\dots\dots(ii)$$

Now dividing equation (i) and (ii), we get;

$$\frac{T_1}{T_2} = \sqrt{\frac{\mu_1 - \mu_2}{\mu_1 + \mu_2}}$$

On substituting the values, we get;

$$\frac{5}{T_2} = \sqrt{\frac{1}{3}}$$

$$T_2 = 8.665 \text{ s}$$



239) Ans. The magnetic flux linked with the coil is given by  $\phi = NBA = 100 \times 50 \times 10^{-4} = 50$  Weber.

240) Ans. When  $\frac{a}{d} \ll 1$  then the diffraction pattern will become very flat and we observe only the interference pattern. Where 'a' is size of the aperture and 'd' is the distance between the apertures

241) Ans. For an open organ pipe  $l = \frac{v}{2n}$   
Using the values of  $v=340\text{m/s}$  and  $n=480$   
We get the length of the organ pipe =  $l = 35.4\text{cm}$

242) Ans. Two waves are said to be coherent if they have no phase difference or have a constant phase difference.

243) Ans. A delicate instrument is protected from the disturbing effects of other charged bodies placed near it by placing it inside a hollow conductor where  $E = 0$ . This is called electrostatic shielding.

244) Ans. The ratio of the fringe width for bright and dark fringes in Young's double slit experiment is 1 : 1

245) Ans. Permanent magnets are prepared by using a hard ferromagnetic rod.

246) Ans. Without coherent sources, the intensity of the interference pattern will not be sustained.

247) Ans. Using the First Law of Thermodynamics:

$$\Delta U = 170 \text{ J} - 70 \text{ J} = 100 \text{ J}$$

$$U_{\text{final}} = 200 \text{ J} + 100 \text{ J} = 300 \text{ J}$$

248) Ans. The truth table for NOT gate also known as inverter is shown below

Input	Output
X	Y
0	1
1	0

249) Ans. As,  $\lambda = \frac{h}{p}$

For same wavelength, momentum is also the same.

250) Ans. During boiling of water although heat is continuously added to the water, its temperature does not change.

251) Ans. An inductor allows DC to pass through it easily whereas it blocks AC of very high frequency.